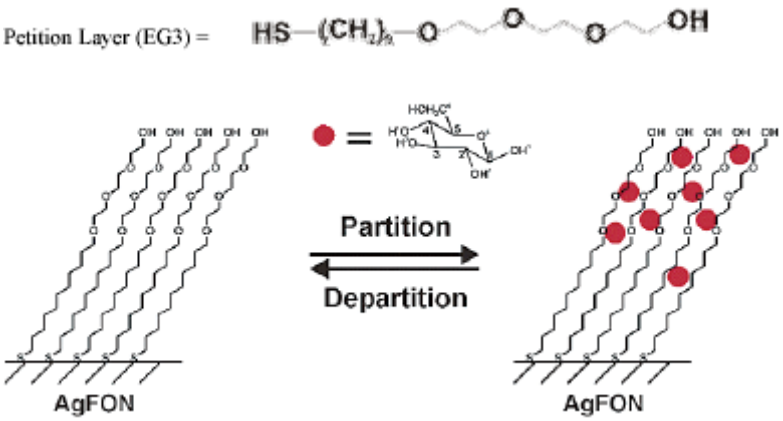
An Improved Glucose Sensor Based on Surface-Enhanced Raman Scattering

Van Duyne and co-workers at Northwestern University have developed a real-time, quantitative, biocompatible glucose sensor based on surface-enhanced Raman scattering (SERS). Detection of glucose in the physiological range (0-450 mg/dL; 0-25 mM) in fluid at pH = 7.4 is demonstrated. The SERS-based glucose sensor operates in fluid for at least 3days, detects glucose in presence of interfering protein, and is reusable. These desirable sensor properties result from the use of the EG3 partition layer.

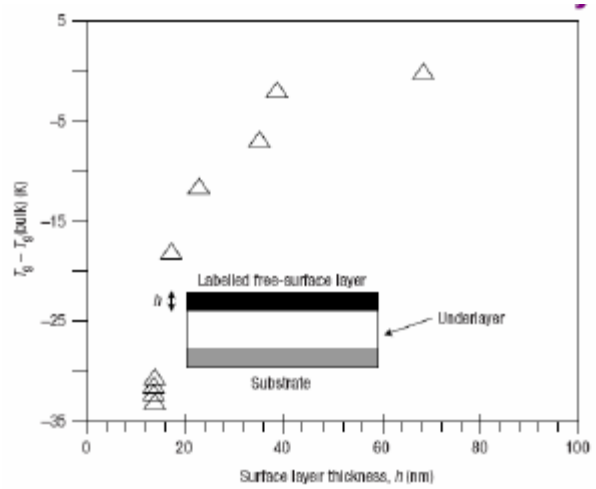


IRG 3 *Molecular Mechanisms of Environmentally Benign Polymer Processing.* Two nuggets are provided.

(1) The first ever synthesis and characterization of gradient copolymers made by ring-opening metathesis polymerization and the second ever synthesis and characterization of gradient copolymers made by nitroxide-mediated controlled radical polymerization were achieved by Professors John Torkelson and SonBinh Nguyen. Complementing that effort, Professors Ken Shull and Monica Olvera de la Cruz developed a self-consistent field theory to characterize the equilibrium properties of gradient copolymers.

John Torkelson

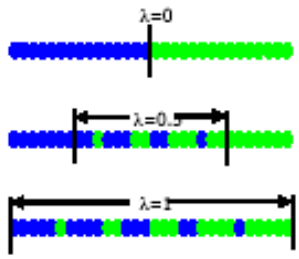
Glasses with Liquid-like, Nanoscale Surface and Interfacial Layers



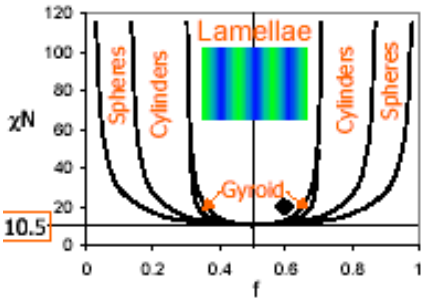
The glass transition occurs when a amorphous material changes from a glassy solid to a viscous liquid upon heating. Surprisingly large shifts in the glass transition temperature, Tg, in nanoconfined polymer films and polymer nanocomposites. Using a multilayer fluorescence method, Ellison & Torkelson from the Northwestern MRSEC are the first to have mapped the effective Tgs as a function of the distance from the surface or interface of films. **from C.J. Ellison and J.M. Torkelson, Nature Materials 2, 695-700 (2003).**

$T_g - T_g$(bulk) identified by fluorescence for pyrene-labelled PS free-surface layers of variable thickness placed on top of constant bulk-like (~270 nm) unlabelled PS underlayers.

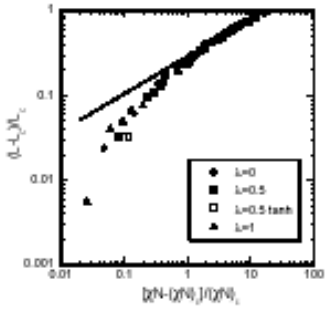
Monica Olvera de la Cruz and Ken Shull
Gradient Copolymer Melts



Block copolymer phase diagram



How does the gradient change phase separation?



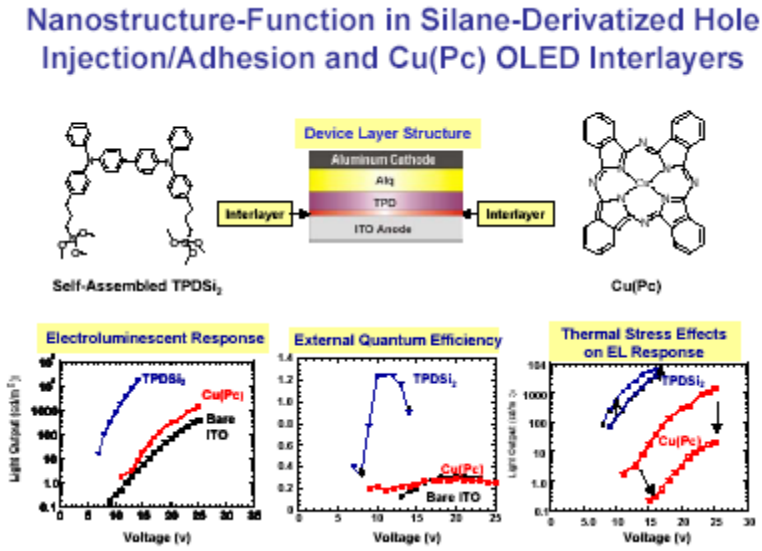
$(X^N)_C$ increases as λ increases. The normalized domain spacing L minus the unperturbed chain size L_C versus the normalized distance of N_X from the critical point at $(X^N)_C$ seems to be independent of the copolymer gradient λ.

Phase Segregation in Gradient Copolymer Melts M.D Lefebvre, M. Olvera de la Cruz, K. A. Shull Macromoelcules 37, 1118-23 (2004)

Tobin J. Marks, Mark A. Ratner, Pulak Dutta

Nanostructure-Function in Silane-Derivative Hole Injection/Adhesion and Cu(Pc) OLED Interlayers

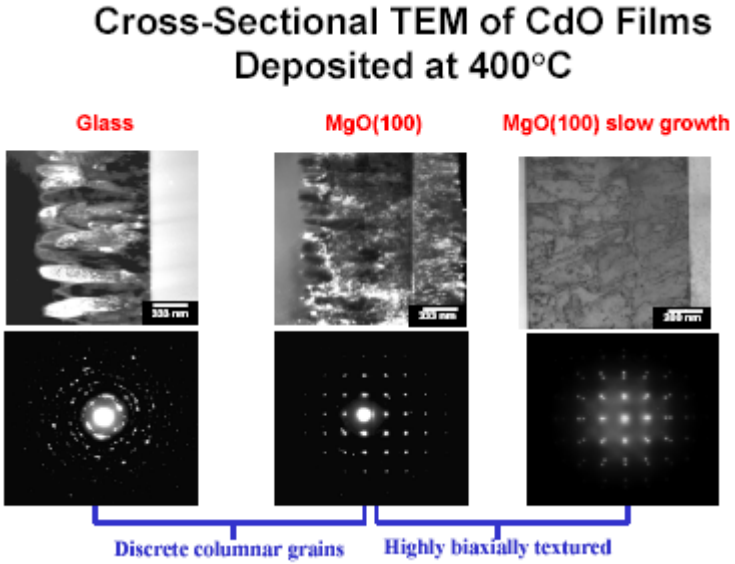
By varying the architecture, structurally well-defined, self-assembling nanostructures composed
of hydrocarbon, silicaceous dielectric, or triarylamine hole-transporting layers can be deposited
on the anodes of organic light-emitting diodes with Å-level precision. They can be used in both
OLED (small molecule organic light-emitting diode) and PLED (polymer light-emitting diode)
devices to balance hole/electron injection fluences, enhance hole injection, and promote physical
cohesion with the with charge-injecting electrodes and adjacent charge-transporting/emissive
layers. The net result is significant enhancement in device light output, quantum efficiency,
improved anode corrosion resistance, and thermal stability.



Good progress was also achieved with seed projects. Several seed projects are currently supported by the MRSEC. They are: Physical and Optical Properties of Quantum-Confined Semiconducting Oxide Nanostructures; X-ray studies of self-assembled electro-optic materials; Biomolecular Materials. Nugget by Michael Bedzyk **Iso-strain X-ray Scattering Studies of Cuprous Oxide Quantum Dots** is provided.

Tobin J. Marks, Vinayak Dravid, Arthur J. Freeman, Carl R. Kannewurf

Transparent conducting oxides (TCOs) are essential components of numerous flat panel display, heat management, and solar energy systems. Nevertheless, these materials are poorly understood, and a major advance would have a significant impact on the aforementioned technology areas. Simple, face-centered cubic CdO is an ideal material to study the fundamental aspects of those factors governing transparent conducting oxide conductivity, transparency, and work function. A detailed study carried out by Marks, Dravid, Freeman, and Kannewurf utilized a new series of highly volatile and easy-to-handle cadmium precursors to grow high-quality CdO films on glass and lattice-matched MgO (100) at relatively low temperatures. Detailed charge transport, optical, and microstructure measurements conclusively connect the greatly enhanced mobilities of the highly biaxially textured films on MgO to a reduction in neutral impurity scattering and/or to a more densely packed grain microstruture. The greater mobilities of the films grown on MgO under very slow growth conditions *can be attributed to differences in carrier concentrations rather than to differences in grain boundary scattering.* This result has significant implications for strategies for enhanicng the performance of next-generation TCOs. Unprecedented CdO conductivities and mobilities as high as 11,000 S/cm and 307 cm2/Vs, respectively, are obtained for epitaxial, single-grain films on MgO.



Mark Hersam

REST and MWM Programs Collaborate to Introduce Nanotechnology to High School Students Nationwide

Education:

Neil Schmidgall, 11-12th grade honors physics teacher at Glenbrook South High School in Glenview, IL, participated in NU-MRSEC's Research Experience for Science Teachers (REST) Program in 2002. Through his participation, he became involved in the Center's Materials World Modules (MWM) Program, which promotes the scientific literacy of students in middle and high school science, technology and math classes and has been used by over 9,000 students nationwide. Neil worked with Dr. Mark Hersam and through

Outreach:

Through his participation in the REST and MWM Programs at Northwestern University, Neil Schmidgall contributed to the development of a new module, which after publication can be used in his physics classroom and in other high school science classes nationwide.